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THE SECONDARY SEXUAL CHARACTERS
OF THE HYMENOPTERA

by

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Introduction

The object of this paper is twofold; first, to bring together all the literature available on the chief secondary sexual characters of the Hymenoptera of North America, and second, to put these statements into such a form that a worker beginning on any group can determine readily, without wading thru a mass of literature, the differences between the sexes. In those forms in which the female has the ovipositor or sting exerted the sexes are easily distinguished, but this is not always the case and in many instances it will be found practically impossible to separate the sexes without dissecting out the genitalia (viz. Braconidae).

It has been noted in several cases, that authors in their keys to a group have made separate keys for the different sexes without explaining the structures by which these may be distinguished. Whether this was due to an oversight, or whether it was taken for granted that a beginner should be able to separate the sexes by instinct or in some other way, we are not able to judge. But we do know that the results may be disastrous to a beginner who is entirely unfamiliar with a group, as has been proved by actual trial.

It is to be regretted that all the references taken could not be verified as to their correctness in connection with the insects themselves, this being due to the lack of material at hand. In some cases it may be found that an insect does not agree with the

characters given; this may be due to the fact that it is an abnormal member of a genus. The writer was fortunate enough to have the opportunity of seeing such a case, a female Tenthredinid which had all the characters of a female, with the exception that the median ventral cleft was absent. However, it appears that these abnormal forms are not common enough to be regarded, and as we are unable to foretell what abnormalities may occur in a form, we can feel safe in disregarding them altogether.

In order to make the paper more serviceable, it has been made as brief as possible. In cases where a single statement would hold for a superfamily or a family, it has been adopted, as in the Tenthredinoidea. It has often been found impossible to make a single statement which would cover an entire family; in such cases statements for the subfamilies have been used. In still other cases it has been found necessary to take up each genus separately and try to provide some statement which would hold, at least, for the genus. In this connection we might add that difficulty was encountered in placing some genera; especially in cases where only a type was mentioned for a description of a genus. These descriptions were often meagre, and secondary sexual characters were rarely mentioned. The writer was unable to trace the following genera: Dicroganium, Stadt, of the family Cosilidae; Neolarra Ashm., of the family Stelididae; Coelioxoides Cress., of the family Nomadidae and Clypeadon, Ashmead, of the family Philanthidae, which probably do not occur in North America.

Ashmead's classification has been followed in regard to families, as it appeared in the Proceedings of the U. S. National Museum Vol. XXIII-1900 No. 1206, with the exception of the Formicoidea when Wheeler was consulted and followed (see Wheeler, Ants, Their Structure, Development and Behavior, p. 133). The reason for this being that Ashmead's classification seems to be the one most generally used in this country and possibly the best in general use at the present time.

Charles W. Metz of Leland Stamford, Jr. University has suggested a method of removing the genitalia from an insect without injuring it to any great extent. The insect is placed in a softening jar until it is sufficiently relaxed and then the genitalia are gently drawn out by means of a fine pair of forceps. This method has proved practicable and the wings of the insects are not injured to any great extent as would be the case in boiling it or placing it in warm water. If it is desired to remove the genitalia entirely, they can be preserved on a slide, mounted in balsam, or, as S. A. Rohwer of the U. S. National Museum suggests, mounted on a cardboard point, attached by balsam, and the point with the genitalia, mounted on the same pin as the insect. The latter method has at least one advantage and that is, the genitalia are not likely to be as easily misplaced as would be the case if they were mounted on a slide. For fine detail study the slide method has the advantage, but is it not possible to dissolve the balsam on the point by means of xylol and then to mount the genitalia on a slide.

if it is so desired.

Where the number of abdominal segments is mentioned as being exposed, it will be noted that the Propodium has not been considered.

This paper is offered, in part, for the degree of Master of Science at the Massachusetts Agricultural College, the work being carried on in the Entomological Laboratory of that Institution, under the guidance of Dr. H. T. Fernald, Head of the Department of Entomology, and Dr. G. C. Crampton; and the writer wishes to take this opportunity to thank them for their interest and encouragement.

He also wishes to acknowledge his indebtedness to Messrs. Viereck, Rohwer, and Crawford of the U. S. National Museum, and also to Charles W. Metz of Leland Stanford, Jr. University.

The Families of Hymenoptera according to Ashmead and published by him in the Proceedings of the U. S. National Museum, Vol. XXIII, 1900 No. 1206. The order is reversed.

Order Hymenoptera

Suborder Phytophaga

Superfamily Tenthredinoidea

Family Cimbicidae

- " Tenthredinidae
- " Dineuridae
- " Nematidae
- " Selandriidae
- " Pterygophoridae
- " Perreyiidae
- " Lophyridae
- " Hylotomidae
- " Lydidae
- " Xyelidae

Superfamily Siricoidea

Family Cephidae

- " Xiphydriidae
- " Siricidae
- " Oryssidae

Suborder Heterophaga

Superfamily Ichneumonoidea

Family Stephanidae

- " Braconidae
- " Alysiidae

Family Ichneumonidae

- " Agriotypidae (only one species mentioned, European in distribution)
- " Evanidae

Superfamily Chalcidoidea

Family Mymaridae

- " Trichogrammidae
- " Eulophidae
- " Elasmidae
- " Pteromalidae
- " Encyrtidae
- " Cleonymidae
- " Miscogasteridae
- " Eucharidae
- " Perilampidae
- " Eurytomidae
- " Chalcididae
- " Torymidae
- " Agaonidae

Superfamily Cynipoidea

Family Cynipidae

- " Figitidae

Superfamily Proctotrypoidea

Family Platygasteridae

- " Scelionidae
- " Ceraphronidae
- " Diapriidae
- " Belytidae
- " Proctotrypidae

Family Heloridae

" Pelecinidae

Superfamily Formicoidea

Family Formicidae (according to Wheeler)

Superfamily Vespoidea

Family Mutillidae

" Myrmosidae

" Thynnidae

" Rhopalosomatidae

" Cosilidae

" Tiphidae

" Scoliidae

" Myzinidae

" Sapygidae

" Trigonalidae

" Bethylidae

" Chrysidae

" Masaridae

" Eumenidae

" Vespidae

" Pselaphidae syno. Pompilidae, Ceropalidae

Superfamily Sphecoidea

Family Ampulicidae

" Sphecidae

" Stizidae

" Nyssonidae

Family Mellinidae

- " Trypoxylidae
- " Philanthidae
- " Larridae
- " Bembicidae
- " Pemphredonidae
- " Crabronidae
- " Oxybelidae

Superfamily Apoidea

Family Proscopidae

- " Colletidae
- " Andrenidae
- " Panurgidae
- " Stelididae
- " Megachilidae
- " Xylocopidae
- " Ceratinidae
- " Nomadidae
- " Anthophoridae
- " Psithyridae
- " Euglossidae
- " Bombidae
- " Apidae

Order HYMENOPTERA

Suborder PHYTOPHAGA

Superfamily TENTHREDINOIDEA

On the ventral surface of the abdomen of the females there is a median ventral cleft which varies in length, but always extends to the apex of the abdomen. Through this cleft the ovipositor is exerted, but this is not always visible in a pinned specimen. The male is without this cleft.

The above statement is based upon the examination of specimens of all of the North American families of this superfamily.

Superfamily SIRICOIDEA

On the ventral surface of the abdomen of the females there is a median cleft which varies in length, but always extends to the apex of the abdomen. Through this cleft the ovipositor is exerted. The male is without this cleft.

The above statement is based upon an examination of specimens of the four families within this group. Additional characters applying to three of the four families will be found below.

Fam. Oryssidae In the male there are seven abdominal segments above, and eight beneath, the last ventral segment being as long as the seventh and broader and rounder at its hinder end. In the female this plate is larger. The male has all the tarsi five segmented, but the female has only three segments in the anterior (pair). In the male the antennae have eleven segments,

the apical segment being conical, while the others are not as irregular as in the female. p 139

Cameron, Mon. Br. Phy. Hym. Vol. III.

An examination of specimens of the genus *Oryssus* shows that the females have seven segments on the ventral surface of the abdomen, while the males have eight. The females also have ten segmented antennae in comparison with the males which have eleven.

Fam. Siricidae The females have a cylindrical abdomen and a strong horny projecting ovipositor. p 124

Cameron, Mon. Br. Phy. Hym. Vol. III.

In all the members of this family examined, it was found that the males had eight abdominal segments and the females seven.

Fam. Xiphydriidae This family was once considered as a genus under the family Siricidae and an examination of specimens indicates that the characters given for the Siricidae will also hold here.

Suborder HETEROPHAGA

Superfamily ICHNEUMONOIDEA

Fam. Stephanidae Ovipositor of the female prominently protuberant with two pubescent valves. p 2.

J. J. Kieffer, Genera Insectorum 77 Me. Fasc.

Fam. Braconidae The antennae of the females are shorter, stouter

and usually with fewer segments than those of the male. Some females are apterous. p 45

T. A. Marshall, Tr. Lon. Ent. Soc. 1885 Pt. I.

In some groups the dorsum has one segment less in the male than in the female. In cases where the ovipositor is not exerted the only safe way for a person unfamiliar with the group to determine the sex of a specimen is to remove the genitalia.

Viereck (in litt.) U. S. Nat. Mus.

Fam. Alysiidae This family is considered as a subfamily of the Braconidae by Von Gy. V. Szepligeti in genera Insectorum Fasc. 22. See latter part of Viereck's statement of Braconidae above.

Fam. Ichneumonidae The females bear an ovipositor, which differs greatly in length according to the species.

Sharp, Camb. Nat. Hist. Vol. VI.

But the above statement does not mean to imply that the female has the ovipositor always exerted; consequently we have to take up the subfamilies separately.

Subfam. Ichneumoninae The ovipositor of the female is not exerted and in many cases it will be found necessary to dissect out the genitalia in order to determine the sex of the specimen. The abdomen of the female ends in a point, whereas in the male it is blunt. The sheaths of the ovipositor are to be distinguished from the claspers of

the male by the fact that they are long and narrow, while the claspers are more rectangular in form.

Subfam. Cryptinae The ovipositor of the female is exserted, prominent, rarely very short. p 10.

Ashmead, Proc. U. S. Nat. Mus. Vol. XXIII 1900

Subfam. Pimplinae Ovipositor always prominently exserted. p 11.
Ashmead (t. c.)

Subfam. Tryphoninae The only way to determine the sex accurately is to dissect out the genitalia.

Viereck (in litt.) U. S. Nat. Mus.

Subfam. Ophioninae Ovipositor either hidden or prominent. The male is slenderer than the female. In case of doubt a dissection of the genitalia is essential.

The above statements for the Ichneumonidae have been verified by the writer.

Fam. Evaniidae

Subfam. Evaniinae (There are only three North American genera)

Genus Evania Fabr. "The abdomen of the female is the shape of an isosceles triangle, the projection being produced into a projection which contains the ovipositor. In the male the abdomen is oval." p. 138

Bradley, Trans. Am. Ent. Soc. XXXIV April 1908.

Genus Evanella Bradley "The abdomen of the female is quite or nearly round, never distinctly triangular, but in one specimen is nearly so; there is sometimes a slight production of the pygidium into a point containing the ovipositor."

"The abdomen of the male varies from round to nearly oval" p 142.

Bradley (t. c.)

Genus Hypatia III. "The abdomen is orbicular, alike in the two sexes. The ovipositor is not exserted, nor are the claspers of the male evident, so that it is usually impossible to determine the sex without a dissection" (of the genitalia). p 149.

Bradley (t. c.)

Subfam. Foeninae Antennae thirteen segmented in the male and fourteen segmented in the female. p 6.

J. J. Kieffer, Genera Insectorum, Fasc. 2

In all the specimens examined the ovipositor is well exserted; and the length of the ovipositor is mentioned by Bradley in all of his descriptions of the female.

Subfam. Aulacinae Antennae thirteen segmented in the male, fourteen segmented in the female. p 11.

J. J. Kieffer, Genera Insectorum, Fasc. 2

Ovipositor long and exserted in the female. p 320

Bradley, Trans. Am. Ent. Soc. XXVII Nov. 1901

Evanidae of No. Am. North of Mexico

Superfamily CHALCIDOIDEA

The female has a median ventral cleft which extends from the point where the ovipositor issues to the apex of the abdomen.

Crawford (in litt.)

Superfamily CYNIPOIDEA

This includes the families Figitidae and Cynipidae.

The ovipositor is not prominent, not coming out from the tip of the abdomen, but from the ventral surface, a little anterior to the tip. Sometimes the ovipositor is accidentally prominent after the insect has laid. p 2.

Dalla Torre and J. J. Kieffer, Genera Insectorum, Fasc. 9

"The number of segments apparent in the abdomen is seven in both sexes, with one less on the ventral side of the female and two less in the male. In the female the apical ventral segment is much larger than the others, and in the gall making species is frequently plough-share shaped, the apex being usually produced into a sharp point which is often hairy." p 149

Cameron, Mon. Br. Phy. Hym. Vol. III.

Superfamily PROCTOTRIPHOIDEA

All families except Pelecinidae

"The ovipositor agrees with the other terebrant Hymenoptera. The outer sheaths of the ovipositor are conjoined and form a tube or scabbard at the tip of the abdomen that affords protection for the ovipositor proper and its two spiculae when not in use." p. 14

Ashmead, Mono. of Proctotrypidae, Bul. 45 U. S. Nat. Mus.

The above reference was taken when Ashmead regarded the families as subfamilies of the Proctotrypidae, but it will doubtless hold now that he has raised them to families of the Proctotrypoidea.

At the apex of the abdomen of the female there is a tube through which the ovipositor is exserted.

Fam. Pelecinidae "Female without ovipositor exserted, but with an extremely long abdomen. The male has no elongation of the abdomen and the proportions are normal." p 563

Sharp, Camb. Nat. Hist. Vol. V

"Abdomen of the female greatly lengthened, slender and cylindrical, about five times the length of the head and thorax united, composed of six segments. Male abdomen clavate." p 198

Ashmead, Ichneumonoidea, Proc. U. S. Nat. Mus. Vol. XXIII

1900 No. 1206

Superfamily FORMICOIDEA

Fam. Formicidae According to Ashmead the Formicoidea contains seven families, but Wheeler maintains that it is erroneous to give them more than subfamily rank under the Formicidae.

See Wheeler, "Ants, Their Structure, Development and Behavior" p 133.

Wheeler distinguishes our main castes in a colony and cites twenty-three

cases of polymorphism under these, which are as follows;

Male The body of the male ant is graceful in form; its sense organs, especially the eyes and the antennae, the wings and the genitalia are highly developed; its mandibles are more or less imperfectly developed, and in correlation with them the head is proportionately shorter, smaller and rounder than in the females and workers of the same species. The male may have modifications.

Macraner is an unusually large form of male which occasionally occurs in populous colonies.

Micraner or dwarf male, differs from the typical form merely in its smaller stature. Such forms often arise in artificial nests.

Dorylaner is an unusually large form peculiar to the driver and legionary ants of the subfamily Dorylinae. It is characterized by its large and peculiarly modified mandibles, long cylindrical gaster and singular genitalia.

Ergataner ergatomorphic or ergatoid male resembles the worker in having no wings and in the structure of the antennae.

Gynoecaner or gynaemorphic male occurs in certain parasitic and workerless genera, and resembles a female rather than a worker form.

Pthisaner is a pupal male which in its larva or semi-pupal state has its juices partially extracted by an Orasema larva. This male is too much depleted to pass on to the imaginal stage. The wings are suppressed, and the legs, head, thorax and antennae remain abortive.

Female or Queen is the more highly specialized sex among ants and is characterized, as a rule, by a larger stature and the more uniform development of her organs. The head is well developed and provided

with moderately large eyes, ocelli, and mandibles; the thorax is large (macronotal) and presents all the sclerites of the typical female Hymenopteron; the gaster is voluminous and provided with well developed reproductive organs. The latter possess a 'receptaculum seminis.' The wings and legs are often proportionately shorter and stouter than in the male. Varieties:

Macrogyne is a female of unusually large stature.

Microgyne or dwarf female, is an unusually small female which in certain ants is the only female of the species and may be actually smaller than the largest workers; in others, microgynes may sometimes be found in the same nest as the typical females.

B. female is an aberrant form of female and occurs either as the only form or coexisting with the normal female which is then called the A female. In this case therefore the female is dimorphic. The B. female is characterized by excess developments in the legs and antennae and in the pilosity of the body or by defective development of the wings.

Ergatogyne ergatomorphic or ergatoid female is a worker like form with ocelli, large eyes, and a thorax more or less like that of the female but without wings.

Pseudogyne is a worker like form with enlarged mesonotum and sometimes traces of other thoracic sclerites of the female, but without wings or very rarely with wing vestiges.

Phthisogyne arises from a female larva under the same conditions as the phthisaner, and differs from the typical female in the same

characters, namely, absence of wings, stenonoty, microcephaly, microphthalmia. It is unable to obtain the marginal instar.

Worker or Ergates characterized by complete absence of wings and a very small (stenonotal) thorax, much simplified in the structure of its sclerites. The eyes are small and the ocelli are usually absent or when present are extremely small. The gaster is small owing to the undeveloped condition of the ovaries. A 'receptaculum seminis' is usually lacking, and the number of ovarian tubules is greatly diminished. The antennae, legs and mandibles are developed.

Gynaeccoid is an egg laying worker. It is a physiological rather than a morphological phase, since it is probable that all worker ants when abundantly fed become able to lay eggs.

Dichthadiigyne or dichthadiiform female is peculiar to the ants of the subfamily Dorylinae and probably represent a further development of the gynaeccoid. It is wingless and stenonatal, destitute of eyes or ocelli, or with these organs very feebly developed and with a huge gaster and extraordinary voluminous ovaries.

Macrergate is an unusually large worker form which in some species is produced only in populous or affluent colonies.

Micrergate or dwarf worker is a worker of unusually small stature. It appears as a normal or constant form in the first brood of all colonies that are founded by isolated females.

Soldier-dinergate is characterized by a huge head and mandibles, often adapted to particular functions (fighting and guarding the nest, crushing seeds or hard parts of insects) and a thoracic structure sometimes approaching that of the female in size or in development of its

sclerites.

Desmergate is a form intermediate between the typical worker and dinergate.

Plerergate "replete" or "rotund," is a worker which in its callow stage has acquired the peculiar habit of distending the gaster with stored liquid food, till it becomes a large spherical sac and locomotion is rendered difficult and even impossible.

Petergate is a worker or soldier with vestiges of wings on a thorax of the typical ergate or dinergate form.

Mermithergate is an enlarged worker, produced by *Mermis* parasitism and often presenting dinergate characters in the thorax and minute ocelli in the head.

Phthisergate, which corresponds to the phthisogyne and phthisaner, is a pupal worker which in its late larvae or semipupal stage has been attacked and partially exhausted of its juices by an *Orasema* larva. It is characterized by stenonoty, microcephaly, microphthalmia and is unable to pass on to the imaginal stage. It is in reality an infraergatoid form.

Gynandromorph is an anomalous individual in which male and female characters are combined in a blended or more often in a mosaic manner.

Ergatandromorph is an anomaly similar to the last, but having worker instead of female characters combined with those of the male.

William Morton Wheeler, "Ants, their Structure, Development and Behavior." pp 93-99

In all the Formicidae that were examined, it was found that the males had thirteen segments to their antennae, and the females, worker and soldiers twelve.

Superfamily VESPOIDEA

Fam. Mutillidae "The female is destitute of wings and ocelli, frequently having the parts of the thorax so closely soldered that the divisions between them are obliterated. The males are winged, furnished with ocelli and have the thoracic divisions distinct." p 94

Sharp, Camb. Nat. Hist. Vol. VI

In all the specimens of this family examined the males have thirteen segmented antennae and seven segments to the abdomen on the ventral surface, while the females have only twelve segmented antennae and six segments to the abdomen on the ventral side.

Fam. Myrmosidae "Thorax in the females divided into two parts, hypopygium in males produced into a sharp aculeus which curves upwards, or very rarely simple." p 49

Ashmead, Journ. N. J. Ent. Soc. Vol. VII Mar. '99

"Males winged, females wingless." p 41

Ashmead, Cam. Ent. Vol. XXXV

There is only one specimen male at hand; the antennae are missing; seven ventral abdominal segments are visible.

Fam. Thynnidae

Female "Apterous, antennae scarcely longer than the head, the scape hollowed at the apex and almost concealing the first joint of the abdomen. Thorax divided into three parts including the median segment more or less contracted in the middle. Femora compressed, posterior coxae contiguous, intermediate coxae nearly always separated by a bilobed projection of the mesosternum. Eyes small, entire, ocelli nearly always absent."

Male "Winged, eyes entire, intermediate coxae separated by a bilobed projection of the mesosternum, intermediate tibiae with two apical spines. Hypopygium usually abnormal." p 2.

Rowland E. Turner, Genera Insectorum, Fasc. 105 1910

Only two specimens, both males, at hand. They have numerous joints to the antennae, but only seven ventral abdominal segments.

Fam. Rhopalosomidae

Genus Rhopalosoma, Cress. (apparently the only genus) "Antennae twelve segmented in the female, thirteen segmented in the male. Femora slightly thickened in the female. Tarsi very slender in the male, flattened and dilated beyond the first joint in the female. Abdomen first segment nearly as long as the remaining segments together in the female, shorter in the male, slender at the base and gradually swollen beyond the middle, much more strongly so in the male, remaining segments slightly incurved at the tip in the female."

p 58

Ashmead, Proc. Ent. Soc. Phil. Vol. IV 1865

Fam. Cosilidae Apparently there are no North American species with the possible exception of members of the genus Dicrogenium, Stad. This genus could not be traced.

Fam. Tiphiidae "Pygidium in male entire, the hypopygium terminating in a sharp aculeus which curves upward." p 196.

Ashmead, Proc. U. S. Nat. Mus. Vol. XXIII 1900

Only four specimens of this family in the material at hand, three females and one male. The male has thirteen segmented antennae, and seven segments on the ventral surface of the abdomen,

while the females have twelve segmented antennae and six segments on the ventral surface of the abdomen.

Fam. Scoliidae

Male, antennae thirteen segmented, long and slender. Body small, slender, and narrow. Three spines on the tip of the abdomen. Spines on legs, but fewer than in the female.

Female, antennae twelve segmented, shorter, thicker built and recurved. Body larger, broader and generally more highly colored than in the male. No spines at the tip of the abdomen. Legs covered with spines, due to their fossorial habits.

O. C. Bartlett, (in litt.) Mass. Agri. College.

An examination of members of this family indicates that the males have seven ventral segments to the abdomen and the females six.

Fam. Myzinidae "Pygidium in the male deeply emarginate at the apex, the hypopygium terminating in a sharp thorn or aculeus, which curves upward and rests in the emargination of the pygidium." p 196

Ashmead, Proc. U. S. Nat. Mus. Vol. XXIII 1900

The female does not possess this aculeus. Antennae twelve segmented in the male, thirteen segmented in the female. Eyes emarginate in male, entire in female. The male's body and legs are very much more slender than those of the female.

S. S. Crossman, (in litt.) Mass. Agri. College

In the specimens at hand it was found that the males had seven abdominal segments whereas the females had six.

Fam. Sapygidae "Antennae thirteen segmented in the male, twelve segmented in the female." p 196

Fam. Trigonalidae

Subfam. Trigonalinae (Seven genera, but none are common to North America)

subfam. Lycogastrinae

Genus Lycogaster Shuckard. Abdomen in female thick, in male abdomen moderately depressed dorsoventrally. p 11

W. A. Schulz, Genera Insectorum, Fasc. 61

Genus Stygnogonalos Schulz. Only a female at hand does not possess "Tyloiden" on the antennae. p 12 Schulz (t.c.)

Genus Lapidogonalos Schulz. Frontal protuberances separated in the male; in the female they are joined together to form a sort of hood above the antennae. The antennae always possess "Tyloiden" on the outer side in the male, sometimes in the female. Sternites of the abdomen of the male unarmed. Second sternite of the female before the hinder border with a slight indication of a protuberance. p 13 Schulz (t.c.)

Genus Tapinogonalos Schulz. Abdomen small and thin. In the female for the most part, closely wrinkled and punctate, on this account feebly shiny to dull; the vertex and abdomen of the male are smooth with a pronounced gloss. Abdomen elongate, spindle shaped, in the female rotund, in the male depressed. The posterior margins of the third, fourth, fifth and sixth tergites of the female slightly depressed and in the middle slightly emarginate or incised; in the male straight and not emarginate. p 14 Schulz (t.c.)

Genus Taeniogonalos, Schulz. Male abdomen slightly depressed. Sternites of the male so far as known, unarmed. p 15 Schulz (t.c.)

Subfam. Seminotinae Abdomen of the male slightly depressed (flattened)

and unarmed. Abdomen of the female rotund and more than one of the sternites armed. Tip of the abdomen of the female strongly turned upwards, with the sternites in a groove. p 10 Schulz (t. c.)

Subfam. Bareogonaloinae. Antennas in the male eighteen and in the female nineteen segmented. Both sexes without "Tyloiden." Abdomen in the male considerably depressed and unarmed; in the female very rotund, with more than one of the sternites armed and with the tip of the abdomen bent towards the ventral side. The male is distinctly smaller than the female. p 18 Schulz (t. c.)

Fam. Bethylidae (Kieffer, nec Ashmead)

Subfam. Sclerogibbinae Ashm. All the females known are wingless; the males have the radial cell constant. p 2

J. J. Kieffer, Genera Insectorum, Fasc. 76

subfam. Bethylinae Ashm.

Genus Parasierola Cameron. This genus is practically connected with Goniozus, Forster by Kieffer. Parasierola Cam. is held as a synonyme of Goniozus, Forster. The latter comes under the Bethylinae of the Proctotrypidas.

"The head in the male is much broader than the thorax with a prominent clypeal carina, in the female longer and less broad. Abdomen in the female pointed ovate or long conical, in the male oblong oval and more depressed." p 73

Ashmead, Bull. 45 U. S. Nat. Mus. 1893

Genus Goniozus Forster. See preceding genus Parasierola, Cam.

Genus Progoniozus Kieffer. This genus contains part of Perisemus, Ashm., the latter being included in the Bethylinae. p. 69 Ashmead (t.c.)

Perisemus Ashm. should be Perisemus Forster. See distinctions for Proctotrypidae, as the Bethylinae was held as a subfamily of the Proctotrypidae.

Genus Digoniozus Kieffer. This genus contains the remaining species of Perisemus, Forster. The preceding statement should hold in this case. p 69 Ashmead (t.c.)

Genus Bethylus Latr. "Pedicel of antennae in female a little longer than the first flagellar joint, in the male shorter." p 52 Ashmead (t.c.)

See distinctions for Proctotrypidae.

Genus Plastanoxus Kieffer (Anoxus Ashmead) "Ocelli subobsolete in the female; eyes in the male oblong, in the female more rounded, slightly hairy. Antennae pilose in the male. Prothorax in the female much elongated, in the male short." p 67 Ashmead (t.c.)

Genus Pristocera Klug. Males winged, females wingless. p 21 Kieffer (t.c.)

Genus Pseudisobrachium Kieffer. Males apterous, females winged. p. 23 Kieffer (t.c.)

Genus Anenesia Westwood. Females wingless, male winged. p. 25 Kieffer (t.c.)

Genus Epyris Westwood. "Antennae long and slender in the male, shorter in the female." p 57 Ashmead (t.c.)

See also characters of the Proctotrypidae, as this genus was placed by Ashmead in the Bethylinae, the latter being held as a subfamily of the former.

Genus Holepyris Kieffer. There is only one species described from North America (Massachusetts). In looking up the description it was found that only a female was mentioned. p 23

Melander & Brues, Biol. Bull. Vol. 5 1903

Genus Rhabdepyris Kieffer. This genus contains part of the genus Epyris Ashmead, and part of the genus Goniozus Forster. Both of these genera belonged to the Bethylinae, consequently distinctions for Proctotrypidae ought to hold here.

Genus Anisepyris Kieffer. Antennae twelve segmented, thirteen segmented in the female. p 32 Kieffer (t.c.)

Genus Acrepyris Kieffer. Only a male described from North America (Texas) p 34 Kieffer (t.c.)

Genus Procalyzoa Kieffer. Only a male described (from Panama) p 34 Kieffer (t.c.)

Genus Dissomphalus Ashmead. Males winged, females apterous. p 35 F. F. Kieffer (t.c.)

Genus Laelilus Ashmead. "Head oblong, nearly as wide across the eyes as long; in the male wider across the eyes than long; eyes large, oval, hairy; ocelli three in a triangle, and larger in the male than in the female. The pedicel of the antennae in the female is a little longer and stouter than the first flagellar joint, in the male slightly shorter." p 50 Ashmead (t.c.)

Genus Paralaelius Kieffer. "Pedicel in the antennae of the female a little longer than the first flagellar joint; in the male shorter." See also distinctions under the Proctotrypidae, as this genus was *Bethylus*, Ashm. and was included under the subfamily *Bethylinae* by him. P 52 Ashmead (t.c.)

Genus Cephalonomia Westwood. Head of the female large, square or quadrangular; eyes small but not punctiform, smooth; ocelli sometimes distinct, sometimes absent. Head of the male more male more rounded; ocelli always distinct; mandibles gradually tapering to a point, apparently simple, but in reality tridentate. p 39 Kieffer (t.c.)

Genus Neoscleroderma Kieffer. "Head in apterous female oblong quadrate, flattened, sub-convex above; eyes small, oblong oval; ocelli wanting. In the female with wings the ocelli are present; in male the eyes are large, prominent, slightly hairy. Mandibles four, dentate in the male. Metathorax sub-quadrata, roundly truncate in the male; longer, abruptly truncate posteriorly in the female with squared sides. Apical margins of segments three, four and five, of the abdomen roundly emarginate in the female, straight in the male." p 44 Ashmead (t.c.)

This genus with the exception of one Australian species is the same as *Ateleopterus*, Forster.

Genus Scleroderma Latreille. "Eyes in the female small, ocelli wanting; eyes and ocelli in the male normal. Males winged; female apterous. Antennae longer in the male, shorter and more incrassated in the female. Metathorax is narrowed basally in the female. The abdomen

is ovate in the male, in the female it is greatly elongated." p 40
Ashmead (t.c.)

Fam. Dryinidae The anterior pair of legs of the females, with the exception of the genus Aphelopus, have a peculiar modification which is not present in any other group of Hymenoptera. This modification has given the insects the name of "pedes raptorii," "pattes ravisseuses," "Raubfusse," "tarsi chelate," etc.

The modification of the tarsus enables them to grasp Homopterous insects, upon which the females feed.

For a description of this apparatus, see p 2.

The male is without this modification.

F.F. Kieffer, Genera Insectorum, Fasc. 54

Genus Aphelopus Dalman. "Antennae shorter in the female than in the male. In female antennae sub-clavate, the scape very short, scarcely longer than the second segment, the other (segments) variable in length; in the male filiform hairy, the scape usually longer than the third, (segment), the last joint (segment) sometimes thickened." p 99

Ashmead, Bull. 45 U. S. Nat. Mus. 1893

Fam. Chrysidae The male is generally narrower and shorter and never possesses an annular styliferous tube. The female is longer and more robust, and armed at the anus with a retractile annular styliferous tube, which may or may not be exerted. Both sexes have thirteen segmented antennae and the same number of visible abdominal segments. p 26

Alex. Mocsary, "Monographia Chrysidiarum Orbis Terrarum Universi." 1889

The above statement hinges on the fact as to whether the styliferous tube is exerted or not. In most cases it is withdrawn.

S. A. Rohwer (in litt.) points out that the antennae of the male may be elongate, but that this character will not hold throughout for a single genus. In many descriptions the sex is not mentioned as it is very difficult to determine. The only safe way to determine the sex is to remove the genitalia.

Fam. Mesaridae Antennae twelve segmented in the female, thirteen segmented in the male. Abdomen consists of six segments in the female, and seven in the male. p 1

This family was considered as a tribe under the Family Vespidae by H. de Saussure in his "Synopsis of American Wasps, Solitary Wasps." Smithsonian Miscellaneous Collections, 25⁴ 1875.

Fam. Eumenidae Antennae twelve segmented in the female, thirteen segmented in the male. The abdomen has six segments in the female, and seven segments in the male. p 1

This family was also considered as a tribe under the Vespidae.

Henri de Saussure (t.o.)

In an examination of specimens of this family, it has been noted that the distal end of the antennae of the female is blunt and that the filamental segments are nearly of equal size, whereas the apical segment of the antennae of the male is pointed and in many cases is strongly recurved; the next to the last segment is much smaller than the others and the last segment is narrower but longer and sometimes

has a distinct hook-like form, (viz. *Eumenes globulosus* Sauss.)

Fam. Vespidae Antennae twelve segmented in the female, thirteen segmented in the male. Abdomen six segmented in the female, seven segments in the male. p 1

Henri de Saussure (t.c.)

The apical segment of the antenna of the male is more pointed than that of the female.

Fam. Psanmocharidae Syns.: Ceropalidae, Pompilidae, Cress.

The antennae of the females twelve segmented, those of the male thirteen segmented. The abdomen of the female has only six segments, whereas that of the male has seven.

Superfamily SPHECOIDEA

Fam. Ampulicidae

Genus Ampulex Only one species occurs in the United States. The males on the average are smaller than the females. The antennae are thirteen segmented in the males and twelve segmented in the females. But above all the males differ from the rest (females) in having the abdomen depressed, and in the shortness of the last abdominal segment. p 458

F. F. Kohl, Ueber Ampulex Jurine

Annalen des K. K. Naturhistorischen Hofmuseums, Bd VIII

Heft 3 U. 4, 1893

Fam. Sphecidae Antennae twelve segmented in female, thirteen segmented in the male. p. 307

H. T. Fernald, Proc. U. S. Nat. Mus. Vol. XXXI

The female has only six ventral plates on the abdomen while eight plates are visible in the male. In the female the abdomen comes to a point, whereas in the male it presents a much blunter appearance.

Fam. Stizidae (Ashmead) Sting if exserted differentiates sexes.

Subfam. Stizinae (Johnson & Rohwer)

Tribe Stizini (Patton)

Group Spheciii "Female, spurs of posterior tibiae greatly enlarged; a sub triangular enclosure on the dorsal valve of the abdomen; sixth ventral segment elongate and acute, hiding the seventh ventral one.

Pleural lobes of the seventh segment not distinct." p 341

Patton, American Stizini, Bull. 3 1879, U. S. Geological and Geographical Survey of the Territories.

In the group Spheciii only one specimen (female) is at hand. It has thirteen segmented antennae, but only six ventral abdominal segments.

Group Stizi "Female, spurs of the posterior tibiae not dilated, reaching only to the middle of the first tarsal joint. Male, three spines or only one at the apex of the abdomen, sixth ventral segment transverse, pleural lobes of the seventh segment separated by an incision on a suture from the tergum" p 344 Patton (t.c.)

It appears that according to Ashmead's classification the group Spheciii contains only one genus *Sphecius* and that the group Stizi would

include the remaining genera.

In the group *Stizi* the females have twelve segmented antennae, whereas, the males have thirteen. The females have six ventral abdominal segments; seven are visible in the male.

Fam. Nyssonidae

Subfam. Gorytinae Dalla Torre & Handlirsch apparently group all the genera in this subfamily into the genus *Gorytes*.

Genus Gorytes Latreille. The females have twelve segmented antennae, whereas there are thirteen segments to the antennae of the males. In the male each segment of the antennae is frequently provided with spines, humps, notches, or curvatures. The antennae of the male are inserted, as a rule, somewhat further away from the clypeus than in the female. p 6 & (321)

The sixth dorsal tergite is of various shapes in the female but it is always triangular along its chief axis; it is flattened on the sides with a more or less sharply carinate surface which always differs from the rest of the abdomen in its sculpturing. On the male the seventh dorsal plate is in many cases hidden behind the sixth.

p 8 & (323)

Handlirsch Mono. d. m. Nysson U. Bembex Sitzungsberichten d. Kais. Akad. d. Wissenschaften in Wien.

Mathem. Natur. Classe; Bd. XCVII Abth. 1 Juli 1888

Antennae thirteen segmented in the male, twelve segmented in the female. Supra-anal valvular of the female provided with a pygidial area. Six ventral segments of the male uncovered. There is

a tarsal comb on the anterior feet of the female. p 413

F.F.Kohl, "Die gottungen der Sphegiden," Ann. des

K. K. Naturhistorischen Hofmuseums, Bd. XI Heft 3 1896

Subfam. Alysoninae

Genus Didineis Jurine & Panzer)

Genus Alyson Wesmael } Grouped by Kohl

Antennae twelve segmented in the female, thirteen segmented in the male. In the male the apical segment of the antennae is more or less cinnately excised. p 402

Supra-anal segment of the abdomen of the female with a sub-triangular pygidial area. There is only a feeble metatarsal comb on the anterior metatarsus of the female. The fifth joint of the anterior tarsus of the female is quite incrassated. The last ventral segment of the abdomen of the male provided with two setiform spines. p 403

F.F.Kohl (t.c.)

Subfam. Nyssoninae

Genus Nysson Latr. (The genera Brachystegus Ach. Costa; Paranysson Guerin; Hyponysson Cresson; Nysson Handlirsch and Gerstacker are regarded by Kohl either as synonyms or as subgenera of the genus Nysson Latr.)

Antennae twelve segmented in the female, thirteen segmented in the male. Apical joint of the antennae of the male irregular in form. Valvula on the supra-anal segment of the abdomen of the female provided with a pygidial area, nearly triangular in form. In the male the area is sub-trapeziform. Only six of the ventral segments of the male are exposed. p. 395

F. F. Kohl (t.c.)

Only three specimens, two females and a male, at hand.

The apex of the abdomen of the male is blunt; in the females it is more conical or pointed.

Genus Foxia Ashmead "Ventral abdominal segments four and five in the female with a lateral tooth, lateral margins of pygidium towards apex serrated. Ventral abdominal segments in the male four, five and six with a lateral tooth, the pygidium at the apex tridentate." p187

Ashmead, Entomological News, Vol. IX 1898

Genus Diploplectron Fox "Anterior tarsi of the female with a comb formed of long, slender and widely separated spines; the male has no tarsal comb. Last dorsal segment of the female with an elongate triangular pygidium." p 38

W. J. Fox, Trans. Am. Ent. Soc. Vol. XX 1893

Genus Astata Latr. Antennae twelve segmented in the female, thirteen segmented in the male. In the female there is a tarsal comb on the anterior tarsus. The eyes of the male are large and are completely opposed. They are smaller and are not opposed in the female. p 339

The pygidial area in the female is triangular, while in the male it is usually somewhat truncated.

The basal alula of the hind wings of the male is markedly larger, broader and has an almost semicircular posterior contour; in the female it differs greatly from the above. p 341

F. F. Kohl (t.c.)

Fam. Mellinidae

Genus Mellinus Fabr.

In the females the orbits are parallel or diverge slightly towards the clypeus; they converge towards the vertex above in the males, they sometimes converge towards the clypeus and the vertex. Mandibles of the male bidentate; of the females tridentate. Antennae twelve segmented in female, thirteen segmented in male. Supra-anal valvular of the female with a distinct triangular pygidial area. Eight ventral segments of the abdomen of the male are exposed, of which the penultimate segment is emarginate behind. p 406

F. F. Kohl, "Die gattungen der Sphegiden"

Ann. des K. K. Naturhistorischen Hofmuseums, Bd. XI

Heft 3 1896

Genus Euspongus Lepel. This genus is held as subgenus of the genus Gorytes, Latr. by Kohl. See his "Die gattungen der Sphegiden," etc. p 412. Consequently the characters given under the genus Gorytes Latr. ought to hold for this genus.

Genus Hypomellinus Ashm. Type Gorytes rufocinctus Fox.

There is only a female described under this type, consequently no comparison can be drawn. p 153

Fox, Canadian Entomologist Vol. XXIV 1892

Genus Mellinozrasta Ashm. Type Gorytes mellinooides Fox.

Evidently the characters given by Kohl under the genus Gorytes will hold in this genus.

Genus Hapalomellinus Ashm. Type Gorytes eximkis Prov.

Although Ashmead states that the male and female have been described by Provancher, only a description of the female was found in Handlirsch

(Mono. d. m. Nysson u. Bembex, Sitzungsberichten d. Kais. Akad. d. Wissenschaften in Wien, Mathern, Natur. Classe, Bd. XCVII Abth. 1 Juli 1888, p 944)

As the type of this genus was originally placed under the genus *Gorytes*, doubtless the main characters should hold as previously described under *Gorytes*.

Conclusion Unfortunately no material is at hand to verify the following statement, but as four out of the five genera were originally included in the genus *Gorytes*, Latr., it would seem that such a character as the female having twelve segmented and the male thirteen segmented antennae should hold for this entire family, especially as the genus *Mellimus* Fabr. also bears out this character.

Fam. Trypoxylidae

Genus Trypoxylon Latr. Antennae composed of twelve segments in the female, thirteen segments in the male. p 140

Jurine, Nour. Meth. Class. Hymenopter 1807

"The hind trochanters of the male are simple." p 377

Rohwer, Ent. News, Nov. 1909, Vol. XX

An examination of specimens of this genus shows that the females have only six ventral abdominal segments, while seven are visible in the males.

Fam. Philanthidae

Subfam. Cerckerinae

Genus Cerckeris Latr. Antennae twelve segmented in the female, thirteen

segmented in the male. Clypeus trilobed, lateral lobes of the male, with the anterior margin provided with a coarctately conjoined fringe. Frons of the female wider than that of the male. p 320

F. F. Kohl, "Die gattungen der Sphegiden,"

Ann. des K. K. Naturhistorischen, Hofmuseums, Bd. XI

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Apex of the infra-anal segment of the abdomen of the female profoundly incised in the middle. Males with seven or eight ventral segments exposed, with the apex of the eighth ventral segment more or less emarginate. Anterior tarsi of the female on the exterior margin provided with a tarsal comb. p 321

F. F. Kohl (t.c.)

The females have only six ventral abdominal segments.

Genus Didesmus Dahl. Kohl maintains that the only differences between the members of this genus and those of the genus Cerceris are the abdominal configurations. Therefore the sexual characters given for the above genus should hold here also.

See F. F. Kohl, p 329 (t.c.)

Genus Eucerceris Cresson. Frons of the female wider than that of the male. Clypeus trilobed, lateral lobes of the male with the anterior margin provided with dense fringes, but not conjoined coarctately. Antennae twelve segmented in the female, thirteen segmented in the male. Supra-anal valvula provided with a pygidial area strongly carinate in the male. Apex of the infra-anal segment in the female deeply excised in the middle. Male with seven or eight ventral segments exposed, apex of the eighth more or less

deeply emarginate. Anterior tarsi of the female, on the exterior margin, provided with a tarsal comb. p 324

F. F. Kohl (t.c.)

Only one specimen, a female, is at hand. It has six ventral abdominal plates exposed, the apical one being deeply emarginate in the middle.

Subfam. Philanthinae

Genus Clypeadon Ashm. No trace of this genus was found.

Genus Aphilanthops Patton. Antennae twelve segmented in the female, thirteen segmented in the male. Supra-anal valvula of the female provided with a large pygidial area. Eight ventral segments of the male are exposed. A tarsal comb is present on the feet of both sexes, but it is larger in the female. p 334

F. F. Kohl (t.c.)

Only one specimen, a female, is at hand. It has six ventral abdominal plates exposed, as contrasted with eight in the male, as given in Kohl's statement above.

Genus Epiphilanthus Ashm. Type *Philanthus solivagus* Say.

No sexual differentiations are given, but a description of the male is found in Proc. Ent. Soc. Phil. Vol. VI 1866 p 57 by Packard, and of the female in Proc. Ent. Soc. Phil. Vol. V 1865 p 103 by Cresson.

However, as the type of this genus is taken from the genus *Philanthus* Fabr. the characters given under the latter genus will doubtless hold in this case. The above statement is further borne out by the examination of specimens of this genus.

Genus Pseudanthophilus Ashm. Type *Philanthus ventilabris* Fabr.

Cresson gives a description of this insect in the Proc. Ent. Soc. Phil. Vol. V 1865 p 98.

The note given under the preceding genus will doubtless hold here.

Genus Philanthus Fabr.) F. F. Kohl holds that the second
Genus Anthophilus Dahl.) genus is a synonym of Philanthus Fabr.
) Therefore the following characters will hold for both genera.

Clypeus trilobed, lateral lobes of the male have a long dense fimbria on the anterior margin. The antennae are twelve segmented in the female and thirteen segmented in the male. The supra-anal valvular of the female is provided with a pygidial area, often only distinct at the posterior end, edged with lateral carinae. Seven or eight abdominal ventral segments of the male are visible, which are more or less fimbriate pilose. A tarsal comb is present on the anterior feet of both sexes. p 330

F. F. Kohl (t.c.)

An examination of the members of this genus at hand, shows that the females have only six ventral abdominal segments, whereas the males have seven or eight, as is mentioned above.

Genus Trachypus Klug. Clypeus trilobate, lateral lobes on the anterior margin of the male are fimbriate pencillate. Antennae thirteen segmented in the male, twelve segmented in the female. Supra-anal valvular of the female provided with a pygidial area, which may or may not be distinct. Ventral segments of the male for the most part not fimbriate. Seven or eight ventral abdominal segments in the male are uncovered, the seventh often being entirely so. Tarsal combs are present on the anterior feet of both sexes. p 333

F. F. Kohl (t.c.)

Conclusion It would appear from an examination of the above genera, with the exception of *Clypeodon* of which no information has been found, that they all possess the following general characters. Antennae of the females twelve segmented and of the males thirteen segments are present. In regard to ventral abdominal segments, seven or eight are visible in the male, whereas only six are visible in the female. It is true that females in many genera have not been seen, but every female examined by the writer has this character. Therefore it is reasonable to suppose that this character is constant throughout the family.

Fam. Larridae

Subfam. Larrinae

Genus Tachytes Panzer. Antennae of the females composed of twelve segments, thirteen segments in the males. Anal segment of the females provided with a triangular area with dense pubescence. Supra-anal segment of the male generally trapeziform, rarely triangular, with a dense silvery or golden pubescence. Eight ventral abdominal segments are exposed, the apical one being excised in the middle. p 363

F. F. Kohl, "Der gattungen der Sphegiden," etc.

The females have only six ventral abdominal segments exposed, in contrast to the males having eight. There is a tarsal comb present in both sexes.

Genus Larra Fabr. Antennae twelve segmented in the females, thirteen segmented in the males. Males have eight ventral abdominal segments exposed, the eighth being entire or emarginated posteriorly. Tarsal

comb present in both sexes. p 347

F. F. Kohl (t.c.)

The one specimen at hand, a female, has six ventral abdominal segments exposed, the male having eight, as Kohl has stated above. Genus Notogonia A. Costa. Antennae twelve segmented in the female, thirteen segmented in the male. Supra-anal segment of the female provided with a pygidial area, distinctly flat, pubescent or tomentose, or partially denuded; posteriorly it is provided with rigid, rod like, compressed spines. Supra-anal segment of the male slightly convex, truncate, tomentose. Eight ventral abdominal segments of the male visible, the apical one being posteriorly excised. Third abdominal segment of the female, below more or less convex. p 355

F. F. Kohl (t.c.)

The female examined has only six ventral abdominal segments. There is a tarsal comb present in both sexes. Genus Ancistromma Fox. Antennae twelve segmented in the females, thirteen segmented in the males. Anal segment of the female provided with a pygidial area, posteriorly covered with pubescence. The pygidial area of the supra-anal valvula of the male, generally trapeziform, provided with pubescence posteriorly. Eight ventral abdominal segments of the male exposed, posterior margin of the eighth either emarginate or entire. Tarsal combs present in both sexes. p 361.

F. F. Kohl (t.c.)

The female has only six ventral abdominal segments. Genus Tachysphex Kohl. Interior margin of the mandibles bidentate

in the females, and either unidentate or entire in the males. Antennae twelve segmented in the females, thirteen segmented in the males. Anal segment with a triangular pygidial area with no pubescence. Supra-anal segment of the male with a trapeziform, rarely a discrete, pygidial area. Eight ventral abdominal segments in the male exposed, posterior margin of the eighth either emarginate or excised. Tarsal combs are present on the anterior feet of the females.

p 366

F. F. Kohl (t.c.)

The females examined have only six ventral abdominal segments.

Conclusion The following characters appear to hold for the subfamily Larrinae. Antennae twelve segmented in the female, thirteen segmented in the male. Eight ventral abdominal segments are visible in the male, while in the female only six are exposed.

Subfam. Lyrodinae

Genus Lyroda Say. Antennae twelve segmented in the females, thirteen segmented in the males. Tarsal comb present on anterior feet in both sexes. Seven ventral abdominal segments of the male are exposed. p 344

F. F. Kohl (t.c.)

The female at hand has only six ventral abdominal segments.

Subfam. Nitelinae

Genus Nitelopterus Ashm. This is a new genus created by Ashmead.

As only a male has been described by him, no sexual differences can be mentioned. p 22

Ashmead, Ent. News Vol. VIII 1897

Genus Miscophinus Ashm. This is a new genus created by Ashmead and the only secondary sexual character mentioned is that the females have the anterior tarsi combed.

See Ashmead p 188, Ent. News Vol. IX 1898

Unfortunately no material is at hand, so that no additional characters can be brought out.

Genus Miscophus Jurine. Antennae with twelve segments in the female, thirteen segments in the male. Anal segment destitute of a pygidial area in both sexes, anal segment conical in the female, muticus in the male. There is a tarsal comb present on the anterior feet of the females. p 446

F. F. Kohl (t.c.)

There are no specimens of this genus at hand, consequently the number of ventral abdominal segments exposed in the male and the female can not be determined.

Conclusion No general statement can be drawn up for this subfamily, as references and material are lacking.

Subfam. Pisoninae

Genus Pisonopsis Fox Eyes in the female strongly emarginate, in the male but slightly so. Last dorsal segment of the abdomen of the female provided with a distinct pygidial area. Last ventral

segment of the abdomen of the male posteriorly emarginate. Seven ventral segments of the male are exposed. Tarsal combs are absent.

p 457

F. F. Kohl (t.c.)

No mention is made of the number of segments in the antennae of either sex. No material at hand.

Genus Pison Spinola Antennae twelve segmented in the females and thirteen segmented in the males. Anal segment of the female conical; pygidial area of the male absent, apical segment sub-truncate or arguate. Tarsal combs on anterior feet are absent. p 458

F. F. Kohl (t.c.)

No mention is made of the number of abdominal segments in either sex. No material at hand.

Genus Bothynostethus Kohl Antennae of the female consists of thirteen segments; the number of antennal segments in the male are not mentioned. Anal segment of the female provided with a large pygidial area, which is protected above by small bristles. Anal segment of the male obtuse posteriorly. A very fine tarsal comb is present on the anterior feet of the females. p 398

F. F. Kohl (t.c.)

It is unfortunate that the statement in regard to the number of segments in the antennae of the female has not been verified, as this is an unusual case. It would also be interesting to know the number of ventral abdominal segments in the male and female. No material is at hand.

Genus Solierella Spinola

)Kohl regards Niteliopsis as
)a subgenus of Solierella;

Genus Niteliopsis S. Saunders

)therefore the following
characters will hold for both
genera.

Antennae twelve segmented in the females and thirteen segmented in the males. The anterior margin of the clypeus of the males may have from one to three teeth. Anal segment of the female is conical, while in the male it is more rounded, the pygidial area is missing above. Seven ventral abdominal segments in the male are exposed. Tarsal combs are absent. p 451

F. F. Kohl (t.c.)

Genus Plenoculus Fox Clypeus, with the lateral lobes of the male provided with a dense marginal fimbria. Antennae twelve segmented in the females and thirteen segmented in the males. Supra-anal segment of the female provided with a distinct pygidial area. Seven ventral abdominal segments of the male are exposed. Anterior tarsi of the females are provided with tarsal combs. p 449

F. F. Kohl (t.c.)

Conclusion No general statement for the entire family Larridae can be formed by the writer, as the references in numerous instances are not full enough, and material is lacking. Moreover, in the genus *Bothynostethus* it will be noted that the females are reported as having thirteen antennal segments, whereas in all other genera, where note is made of the fact, it will be found that the antennae in this sex have only twelve segments.

Fam. Bembicidae

An examination of different members of the various genera of this family has brought out the following facts. The females have twelve segmented antennae, the segments being simple. There are

thirteen segments to the antennae of the males and these are often modified toward the apex by excisions, etc. Tarsal combs are present in both sexes, but are much larger in the females, the individual spines being much longer and stouter. The females have six unmodified ventral abdominal segments, the apical one being conical. In the male from seven to eight abdominal segments are present, the apical one is not as concial as in the female, but is more truncated. Furthermore, spines are often present on the sides of the apical segments. On the second abdominal plate in the genus *Steniola*, Say, there is a spine-like projection which extends posteriorly. Additional characters are present in the different genera, but they do not hold for the entire family.

Fam. Pemphredonidae

The only general statement which will apparently hold for the entire family is that the females have antennae with twelve segments, while there are thirteen segments to the antennae of the males. As the antennae are often missing, the following generic characters may be used in addition.

Subfam. Pemphredoninae

Genus Ammoplanus Giraud Supra-anal segment of the female provided with a sub-triangular pygidial area. Seven ventral abdominal segments of the male are exposed. Tarsal combs are absent in the female. p 270

F. F. Kohl, "Die gattungen der Sphegiden"

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Genus Spilomena Suckard Supra-anal valvula of the female greatly

compressed, provided with a very narrow pygidial area, with the margins parallel. Infra-anal valvula of the male not compressed, and no spinous process is present. p 272

F. F. Kohl (t.c.)

Genus Stigmus Jurine Supra-anal valvula of the female with a distinct pygidial area. Infra-anal segment of the male compressed; there is a spinous process on the posterior margin of the eighth ventral segment. p 274

F. F. Kohl (t.c.)

Genus Pemphredon Lat.)Kohl holds that Cemonus Lat. is a
Genus Cemonus Jurine)subgenus of Pemphredon; therefore the
)following characters will hold for
 both genera.

Interior margin of the compound eyes of the male parallel or converging slightly towards the clypeus. Supra-anal valvula of the female with a pygidial area, bordered with two lateral carinae, rarely with a single median carina. Supra-anal valvula of the male without a pygidial area, seven ventral abdominal segments exposed, the eighth protracted under the seventh. p 285

F. F. Kohl (t.c.)

An examination of the females shows that there are only six ventral abdominal segments exposed.

Genus Passaloecus Suckard Fascies of the male with a silvery pubescence below. The supra-anal valvula of the females always lacks a pygidial area; in the males the greater part of it is hidden beneath the preceding segment. Seven ventral segments of the male are distinctly exposed, the median posterior part of the eighth produced below the seventh in

the form of a longitudinal spine. p 282

F. F. Kohl (t.c.)

Genus Diodontus Curtis Frons of the female especially wide. Fasicles of the male silvery pubescent below. Clypeus of the female medianly biarcuately emarginated; of the male medianly more or less deeply or narrowly excised. Both sexes are provided with a pygidial area. In the male seven ventral abdominal segments exposed, the eighth being practically completely hidden. p 279

F. F. Kohl (t.c.)

Subfam. Pseninae

Genus Psen Lat) Mimesa is regarded as a subgenus of
) Psen by Kohl. He gave the following
Genus Mimesa Shuckard) characters for both genera.

Flagellum of the antennae sub-clavate or sub-filiform, not at all moniliform in the male; segments two to five of the female distinctly longer than wide. Supra-anal segment of the female provided with a flat and sometimes large pygidial area. Six ventral segments of the male are exposed, the seventh is hidden, the eighth emitting a reflexed hook; supra-anal valvula practically hidden by the preceding segment. p 289

F. F. Kohl (t.c.)

The females examined have only six ventral abdominal segments. The male abdomen can be recognized from that of the female by the presence of the reflexed hook at its apex. This is the first time in the entire superfamily, in specimens examined by the writer, that the male has the same number of ventral abdominal segments exposed as the female.

Fam. Crabronidae

Antennae of the females twelve segmented; in the males there are generally thirteen segments, but in a few cases only twelve are reported. The female antennae are simple, whereas those of the male may be simple or may be provided with excisions, dentations, or dilations, etc. The females always have a pygidial area, whereas it may or may not be present in the males. The abdomen of the female is more pointed at the apex than it is in the male; in the latter, it generally appears truncated. The females have only six ventral abdominal segments exposed, whereas in the male eight are visible. The anterior legs of the male are subject to more modifications than those of the female.

Fam. Oxybelidae

Antennae twelve segmented in the females, thirteen segmented in the males. Both sexes provided with a pygidial area on the supra-anal valvula; it is sub-triangular in the females, trapeziform or rectangular quadrangular in the males. Eight ventral abdominal segments are exposed in the males. Tarsal combs are present in both sexes.

The one specimen at hand is a female and has only six ventral abdominal segments.

The above statements are compiled from the various generic characters, which were found in references.

Superfamily APOIDEA

In all the specimens of the superfamily Apoidea examined by the writer, it was found that the females had twelve segmented antennae, whereas

there were thirteen in the males. It was also noted that the females had six abdominal segments visible, though in some cases only five are plainly seen above, as in the case of the Halictinae. However, six ventral ones are plainly visible in these cases. The reverse may be the case and six segments may be visible above and only five below. In the males seven segments are generally visible both above and below, but sometimes as in the case of the genus Prosopis, only the tip of the seventh is visible. However, seven segments will be visible either above or below.

In many cases the abdomen is contracted and it is practically impossible to see all the segments; in order to facilitate the separation of the sexes when this occurs, the following characters may be used.

Specimens of the Family Euglossidae, which do not occur north of Mexica, and of the Subfamily Meliponinae, also chiefly southern forms, have not been examined and it can not be stated positively whether they will possess the above characters or not, as no reference has been found in regard to these points, but it appears reasonable that they should, as the characters are so wide spread throughout the remainder of the group.

Fam. Prosopidae

Genus Prosopis Fabr. There is more yellow on the face of the males than there is on that of the females, the latter rarely having any on the clypeus. The scape of the males is swollen and may have some yellow on it; the scape of the females is slender and is black.

Chas. W. Metz (in litt.), Leland Stanford, Jr. Univer.

Fam. Colletidae "The hind tibia and tarsi of the female always with a distinct pollen brush." p 93

Ashmead, Trans. Am. Ent. Soc. Vol. XXVI 1899

Fam. Andrenidae

Subfam. Andreninae "The scopa on the hind legs of the female always distinct and well developed." p 87

Ashmead, Trans. Am. Ent. Soc. Vol. XXVI 1899

Subfam. Halictinae "Hind femora and tibiae in the female with a distinct flocculus or scopa. The apical dorsal abdominal segment of the female has a median groove or rima. This is not present in the male." p 87

Ashmead (t.c.)

Subfam. Sphedocinae

Genus Sphecodes Latr. In addition to the general statement for the superfamily, no general character is apparent. The females have no polleniferous scopa.

Fam. Pamurgidae Not all the genera mentioned by Ashmead (in Trans. Am. Ent. Soc. Vol. XXVI p 82 1899) as members of this family were represented by specimens in the collection at hand. Nor did many references give sexual differences, but those which gave generic sexual distinctions are mentioned below.

Genus Macropis Panzer "Clypeus in male yellow" p 83

Ashmead, Trans. Am. Ent. Soc. Vol. XXVI 1899

Genus Parandrena Robt. "Abdomen in the female rufous or brownish.

Clypeus in the male yellow." p 83

Ashmead, (t.c.)

Genus Dufourea Lepel "Antennae of the male not longer than the thorax; flagellum simple." p 83

Ashmead (t.c.)

Genus Biareolina Dufour

This genus is held as a subgenus of *Andrena* by both Cockerell and Dalle Torre. Mr. Vachal states that "The sixth ventral segment of the male has lateral projecting points." p 187

Cockerell, Trans. Am. Ent. Soc. Vol. XXIV 1903

Genus Rhophitooides Schenck "Face in the female with white hairs; antennae in the males as long as the thorax, the last joint acuminate at the apex only." p 83

Ashmead (t.c.)

Genus Cockerellia Ashm. "Claws in the female simple, in the male with the anterior and middle claws cleft, the hind claws being simple." p 85

Ashmead (t.c.)

Genus Panurgus Latr. "Hind tibiae and tarsi in the female with a long, dense pubescence; clypeus in the male black, with long hairs." p 85

Ashmead (t.c.)

Genus Macroteropsis Ashm. "Abdomen in the female black, in the male red." p 85

Ashmead (t.c.)

North American forms?

Fam. Stelididae See statement for preceding family.

subfam. Stelididinae

Genus Melanostelis Ashm. "Male with the pygidium sub-emarginate, the hypopygium tridenate." p 79

Ashmead, Trans. Am. Ent. Soc. Vol. XXVI 1899

Genus Protostelis Friese. "Male with the anal segment entire, rounded, ending in a strong thorn." p 79

Ashmead (t.c.)

North American forms?

Genus Stelis Panzer "Male with the seventh abdominal segment rounded." p 80

Ashmead (t.c.)

The above statement could not be verified owing to the lack of material at hand. This condition might also occur in the female.

Subfam. Coelioxinae

Genus Coelioxys Latr. "Abdomen conical in the female, acuminate at the apex. Abdomen in the male armed with porrect teeth or spines." p 82

Ashmead (t.c.)

Fam. Megachilidae

"The abdomen of the female is always provided with a ventral scopula." p 71

Ashmead, Trans. Am. Ent. Soc. Vol. XXVI 1899

Fam. Kylocoptidae

"Hind tibiae and tarsi in the females furnished with a dense polleniferous scopula." p 70

Ashmead, Trans. Am. Ent. Soc. Vol. XXVI 1899

Fam. Ceratinidae

Genus Zadontomerus Ashm.) Following characters apply to

Genus Ceratina Latr. both genera.

"The males have the mandibles bidentate, whereas they are tridentate in the females." p 69

Fam. Nomadidae See statement under the family Pamurgidae.

Genus Crocisa Latr. The males have the last abdominal segment terminated in a wide plate, slightly excised, while that of the females appears to be trifid, i.e. composed of the sting and of two small lateral plates covered with hair. p 239

Jourine, 1807, Nouvelle Methode de Classer les Hymenopteres.

Genus Nomada Scopoli Anterior claws deeply bifid in the males; all the feet of the females are provided with large basal spines. The males differ from the females in having the head and thorax densely pilose and the abdomen narrowly pointed with seven segments. p 15

H. L. O. Schmiedeknecht, Apidae Europaeae

Tomus I 1882-1884

The amount of pilosity varies and therefore does not appear to be a very good character.

Fam. Anthophoridae

"Female with a dense polleniferous scopula on the hind tibiae and tarsi." p 19

Ashmead, Proc. U. S. Nat. Mus. Vol. XXIII 1890

Fam. Psithyridae

Genus Psithyrus Lepeletier "Female with corbiculae, with the hind tibiae dorsally convex and densely pilose; hind tarsi not forcipate at the base; anus inflexed. Male with the hind tibiae equally pilose, the genitalia, squama and lacinia always membranous." p 58

Ashmead, Trans. Am. Ent. Soc. Vol. XXVI 1899

Fam. Euglossidae Specimens of this family have not been examined, but Ashmead gives the following:

"Hind tibiae and metatarsi in the female strongly dilated, outwardly concave; metatarsus forcipate. Females with corbiculae, but with the polleniferous scopa on the hind tibiae and tarsi very sparse or thin and confined to the lateral edges." p 191

Ashmead, Proc. U. S. Nat. Mus. Vol. XXIII 1900

These forms are South, Central American and Mexican in their distribution.

Fam. Bombidae "Three castes. Females and workers with corbiculae and a dense polleniferous scopa on the hind tibiae and tarsi." p 54

"Females and workers with posterior tibiae dorsally depressed, polished and furnished with corbiculae; post. tarsi, first joint angulated above, forming a forcipate hook externally." Male with the posterior tibiae above, more or less shiny, somewhat concave." p 57

Ashmead, Trans. Am. Ent. Soc. XXVI 1899

The only way to determine the females from the workers is by their size, the former being the larger.

H. J. Franklin (in litt.) Mass. Agric. College.

Fam. Apidae

Subfam. Meliponinae No material at hand, but as the other subfamily of the Apidae have twelve segmented antennae in the females, and thirteen in the males, and abdomens with six segments in the females and workers, and seven segments in the males, it appears that the above characters should be present in this group also. A sting is not present in this

group.

Subfam. Apinae

"The females and workers possess stings. The worker has a corbiculae, this is absent in the female." "In the males the eyes are holoptic."

p 56 & 57

Ashmead, Trans. Ent. Soc. Am. Vol. XXVI 1899

